Geophysical Research Abstracts
Vol. 20, EGU2018-8181, 2018
EGU General Assembly 2018

Effects of NBZ events on Polar Cap (PC) index calculations

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The convection of magnetospheric and ionospheric plasma across the polar caps generates oppositely directed E-region currents that induce the magnetic variations reflected in the Polar Cap (PC) indices. The convection relates to properties of the solar wind, primarily the velocity (Vsw) and the sign and magnitude of the Z-component, Bz, of the Interplanetary Magnetic Field (IMF). With IMF Bz negative (southward) or just small in magnitude, the convection across the polar cap is antisunward with sunward return flows in the morning and evening sectors of the auroral oval. With IMF Bz strong and positive (northward), strong sunward convection may develop in the central polar cap with return flows poleward of the usual auroral oval (NBZ conditions). The NBZ sunward convection maximises close to local noon at latitudes between the cusp and the pole (e.g., Stauning et al, 2002). In addition to depending on the strength of IMF Bz, the reverse convection intensities relate to the ionospheric conditions, in particular, the conductivity varying with local time, season and solar cycle, and also depend on location and geomagnetic field configuration. The immediate effect of reverse convection is to generate negative PC index values. However, inclusion of reverse convection events in the data base used to derive index coefficients has adverse consequences for the quality of the PC indices by adding the dependencies of NBZ events on local conditions to the index values and, furthermore, enhance saturation effects. The paper shall illustrate properties of reverse polar cap convection events as seen both from satellite and ground data and discuss their adverse effects on frequently used PC index versions.